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**Abstract**

## Irradiation Behaviour of Swedish Steels for Reactor Pressure Vessels

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Present Swedish power reactors are designed with steel pressure vessels and the embrittlement of pressure vessel steels by neutron irradiation has therefore been a subject for detailed study. Results from some thirty irradiation experiments in the R2, DR2 and DR3 reactors are now available. A systematic study of the effects of irradiation dose ($10^{18}$-$10^{20}$ nvt>1 Mev) and irradiation temperature (50-300°C) has been made on three C-Mn mild steels, including ASTM A212B; three low alloy Mn-Mo steels including ASTMA302B; a B-Mo alloy steel and two versions of a martensitic austenitic 13 Cr 6 Ni steel. These steels have been irradiated in the conventional conditions as produced by the manufacturer but, in co-operation with industry, metallurgical variables including the effects of grain size, deformation ageing and quenching and tempering have also been considered in certain cases.

The irradiation changes in the hardness, impact energy to fracture and tensile strength of these steels have been measured and show different steels, or different conditions of the same steel, to exhibit widely differing susceptibilities to irradiation embrittlement. For this work conventional testing techniques have been used but in addition a miniature Charpy V specimen has been developed. This has been found to be eminently satisfactory for the irradiation of two or more steels under identical conditions of temperature and neutron flux in rigs of limited volume. This work allows both an assessment of the irradiation behaviour of Swedish pressure vessel steels at present available as well as a comparison with certain standard American qualities.

The brittle ductile transition temperature of a pressure vessel steel is affected by factors and treatments other than neutron irradiation and an assessment of a steel's suitability for use in a reactor vessel must include careful consideration of aspects such as stress relieving, deformation ageing, heat affected zones around welds and the properties of the weld metal. The significance of irradiation effects as well as other metallurgical variables influencing the brittle ductile transition temperature and affecting the use of steel in reactor pressure vessels will be discussed.

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